



Dall's Sheep Survey of the Liard and Nahanni Ranges, Mackenzie Mountains, August 2011

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ABSTRACT

We conducted an aerial survey for Dall's sheep (*Ovis dalli dalli*) in the Liard and Nahanni Ranges of the Mackenzie Mountains on 25 August 2011 to document sheep distribution and the lamb crop. Sheep were classified from the air into four sex/age classes: lambs, yearlings, ewes, and rams. We used digital photographs to verify sex/age classifications of large groups. We used a handheld global positioning system to track the survey flight path and record the locations of all wildlife seen. We classified 63 Dall's sheep in 15 groups on the Nahanni Range and 203 Dall's sheep in 35 groups on the Liard Range, estimating 76.9 lambs/100 ewes and 57.7 rams/100 ewes and 39.7 lambs/100 ewes and 35.3 rams/100 ewes for the two ranges, respectively. Other wildlife observed during the survey included one moose (*Alces americanus*), seven bison (*Bison bison athabasca*) and ten trumpeter swans (*Cygnus buccinator*).

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INTRODUCTION

There has been limited research conducted on Dall's sheep in the Mackenzie Mountains (Veitch et al. 1998), with the most extensive research being conducted in the 1960s and 1970s (Simmons 1982, Simmons et al. 1984). In the 1980s, sporadic aerial surveys were conducted for Dall's sheep in different southern ranges of the Mackenzie Mountains to document numbers and distribution, and provide estimates of productivity (Ferguson et al. 1985, Case 1989). These surveys were conducted in response to new mining and gas developments in the area. Aerial surveys were not conducted again until 2003 (Larter and Allaire 2005).

Ground-based classification surveys have been collected on an almost annual basis from 1997-2014 in two study areas in the northern Mackenzie Mountains, Katherine Creek and Palmer Lake to the west of Norman Wells (Heather Sayine-Crawford personal communication). Since 1995, the observations of non-resident hunters have been collected on a voluntary basis, with these data being used to estimate demographic measures of Dall's sheep. The number of lambs and rams per 100 ewes pooled over the entire Mackenzie Mountains is reported (Larter and Allaire 2015).

Rarely is there the opportunity to conduct aerial Dall's sheep surveys in the Mackenzie Mountains. Fortunately some helicopter time became available at the end of the 2011 fire season. We took this opportunity to conduct an aerial survey of the Nahanni and Liard Ranges to document numbers and distribution, and provide estimates of productivity. These same two ranges had been surveyed in August 2003, also when helicopter became available at the end of the fire season. We report the current distribution and sex and age composition of Dall's sheep in the Nahanni and Liard Ranges and compare with survey results from the same area and elsewhere in the Mackenzie Mountains.

STUDY AREA

The survey area is located in the southeast portion of the Mackenzie Mountains falling in the boreal cordillera ecological region; the Nahanni Range in the high boreal and the Liard Range in the mid-boreal (Ecosystem Classification Group 2010). Because of the complexity of geological formations and wide variations in altitude and soil conditions, the area contains a wide variety of habitat types (Simmons 1982, Ecosystem Classification Group 2010).

The Nahanni Range features a long narrow limestone ridge with steep escarpments and subalpine coniferous forest and provides good Dall's sheep habitat. Its limestone geology has resulted in an abundance of caves, some very large and deep. Case (1989) describes a cave that extended 40-45m inside from the mouth. Sheep often use these caves for both shelter and protection from predators (Clay Lancaster personal communication); their use of caves keeps them out of sight from aerial surveyors. The Nahanni Range ravines are more irregularly spaced than those of the Liard. Two large deep lakes bisect the range at its northern end. Sheep are rarely found north of Little Doctor Lake, the southernmost lake.

The Liard Range is a long sinuous jagged shale, sandstone and limestone ridge which runs adjacent to the Liard River. The terrain drops off rapidly to the east. To the west less steep terrain slopes to the Kotaneelee Valley. Deep ravines occur throughout the length of the range. Mixed-wood

deciduous and coniferous forests are found in the valley floors, with lodgepole pine (*Pinus contorta*), spruce (*Picea* spp.), and alpine fir (*Abies lasiocarpa*) found at higher elevations. The Liard Range provides excellent Dall's sheep habitat (Ecosystem Classification Group 2010).

Currently, Dall's sheep populations in the survey area remain relatively isolated with a limited degree of man-made disturbance. Resident and subsistence harvest is minimal. Non-resident trophy hunters are required to use the services of an outfitter (Environment and Natural Resources 2015). All but the northern part of the Nahanni Range falls within the boundaries of the Nahanni Butte Outfitters. The Department of Environment and Natural Resources records the Dall's sheep harvest by non-resident hunters in the Mackenzie Mountains (Larter and Allaire 2015). Non-resident harvest of sheep from the survey area is ≤ 8 rams annually.

METHODS

We used an A-star helicopter for the survey, completing the Nahanni Range first by flying a sinusoidal path the length of the range following Larter and Allaire (2005). All attempts were made to avoid directly approaching sheep to minimize disturbance and flight of the animals (Frid 2003). For the Liard Range, we flew each side of the range separately completing the east side first. The helicopter flew parallel to the peak of the range and at an elevation below the peak as much as possible to minimize disturbance of sheep on the other side of the range (Frid 2003).

Observers were located in the front passenger seat and the rear right seat directly behind the pilot. They classified sheep into four sex and age classes: ram, ewe, yearling, and lamb. Observers used 7x35 binoculars to assist with classification. The recorder was seated in the rear left seat with a handheld GPS that was used to waypoint all wildlife observations and record a track log. Digital photos were taken of larger groups to verify sheep numbers and the age and sex of each sheep observed.

For comparisons with some previous surveys we defined nursery sheep as the number of ewes plus the number yearlings seen.

RESULTS

We flew for 78 minutes (0948-1106) along a 144 km flightline to cover the Nahanni Range observing 15 groups of Dall's sheep (Figure 1). We flew for 108 minutes (1205-1353) along a 137 km flightline on the east side of the Liard Range observing 15 groups of Dall's sheep. After refueling we flew 65 minutes (1433-1538) along a 136 km flightline on the west side of the Liard Range observing 20 groups of Dall's sheep (Figure 2). See Table 1 for the composition of the Dall's sheep observed in the survey.

Table 1. The number of groups, different sex/age classes, and ratios of lambs and rams per 100 ewes (L:E and R:E, respectively) of Dall's sheep observed during the 2011 and 2003 (Larter and Allaire 2005) surveys.

2011

Range	Groups	Ewes	Lambs	Yearlings	Rams	Total	L:E	R:E
Nahanni	15	26	20	2	15	63	76.9	57.7
Liard	35	116	46	0	41	203	39.7	35.3
Total	50	142	66	2	56	266	46.5	39.4

2003

Range	Groups	Ewes	Lambs	Yearlings	Rams	Total	L:E	R:E
Nahanni	13	40	18	1	9	68	45.0	22.5
Liard	17	52	31	3	36	122	59.6	69.2
Total	30	92	49	4	45	190	53.3	48.9

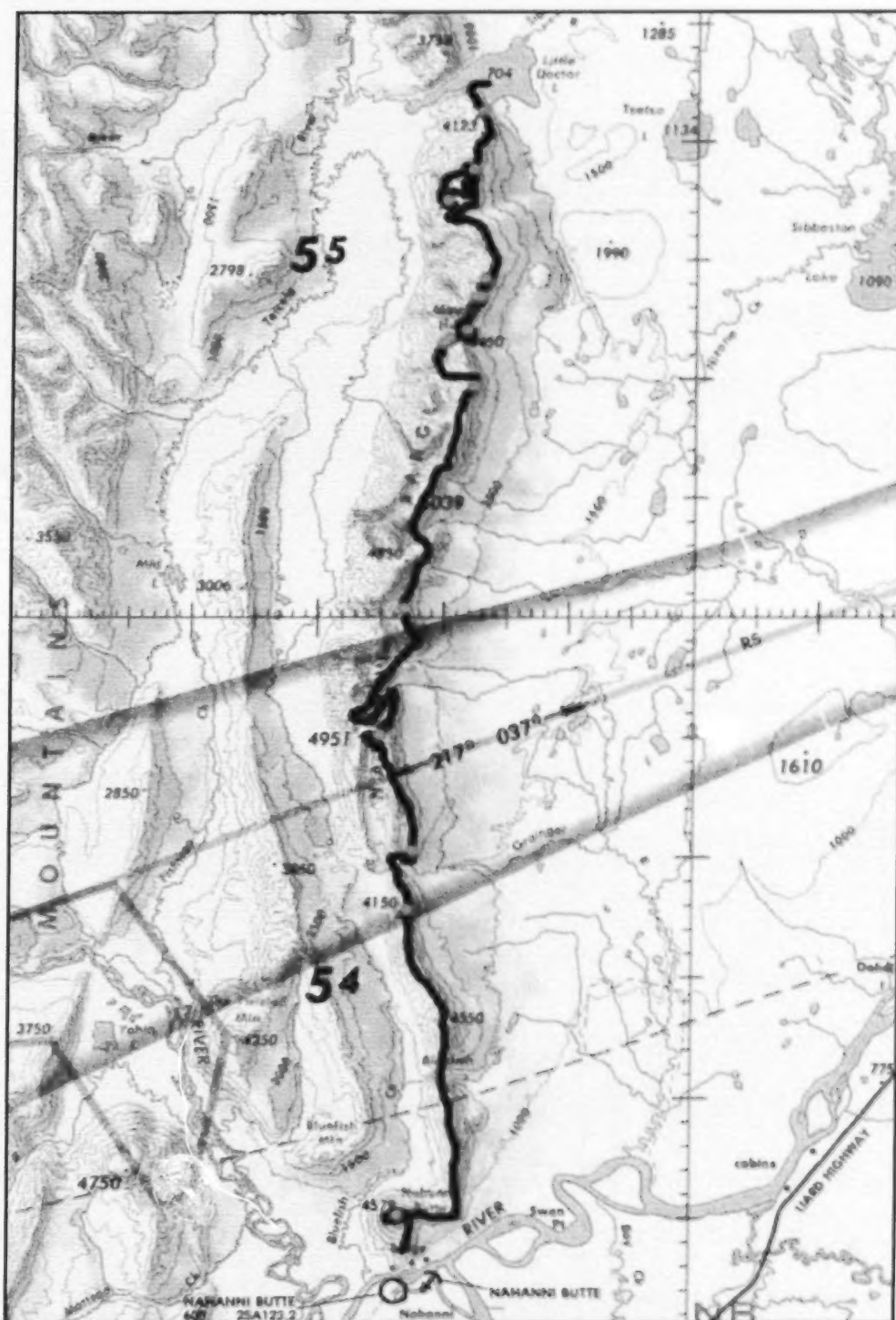


Figure 1. Nahanni Range survey flightline in black and locations of groups of Dall's sheep in red.

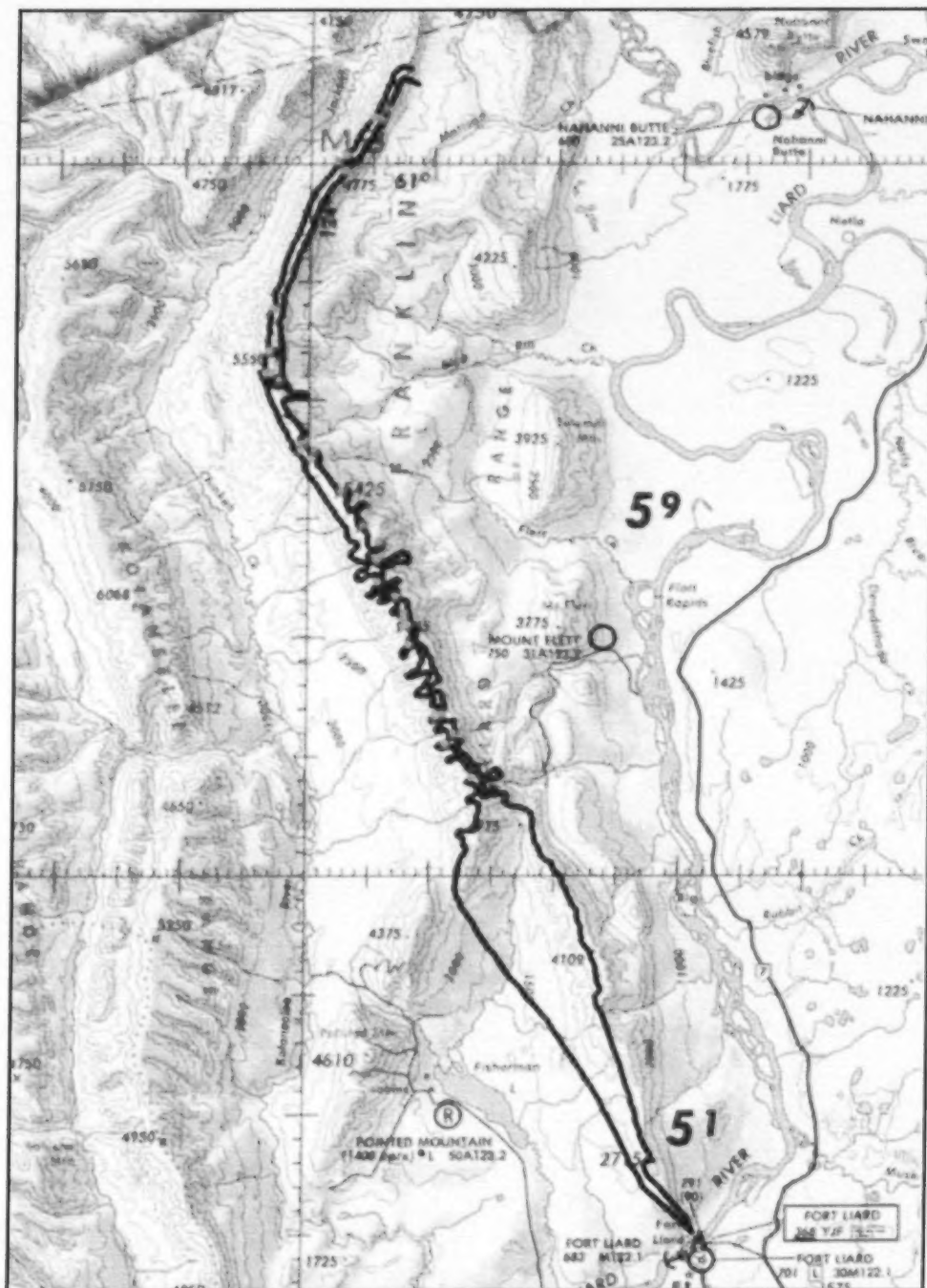


Figure 2. Liard Range survey flightline in black and locations of groups of Dall's sheep on the east side in red and west side in green.

DISCUSSION

Historically, the Liard Range has had more resident Dall's sheep than the Nahanni Range (Case 1989, Larter and Allaire 2005). For this reason we spent more time surveying the Liard Range. Because the Liard Range is essentially a single jagged mountain ridge, we decided to fly the east and west side separately instead of a single spaghetti type flightline that crossed back and forth over the ridge.

The number and distribution of sheep observed on the Nahanni Range was strikingly similar between the 2011 and the 2003 surveys (Tables 1, 2). Both surveys were conducted at almost the same date on August, 24th in 2003 and August 25th in 2011, and at a similar time of day. Although there were fewer rams observed in the 2003 survey, the most noticeable difference between the two surveys is the much higher lamb/100 ewes recorded in the 2011 survey. Consistent with the 2003 and 2011 surveys of the Nahanni Range, the majority of sheep observed in the 1986 survey were distributed north of the Grainger River. The 1986 survey was conducted over a two day period in June; therefore it is not surprising that more sheep were observed in this survey. What is surprising is the extremely low number of lambs/100 nursery sheep (7.2; Table 2). Ratios are expected to be higher in June than later in the summer, unless there has been an almost complete lamb failure. Case (1989) was convinced that the total number of sheep and the number of lambs/100 nursery sheep was underestimated in the 1986 survey. The underestimates he attributed to the use of caves in the range by sheep of all sexes and ages.

Table 2. Survey results from the Nahanni and Liard ranges done in different years. Nursery sheep are all ewes and non-breeders. Surveys conducted in August except where noted.

Range	Yr	Nursery	Lamb	Ram	Total	L:N	R:N	Reference
Nahanni	86	69	5	29	107	7.2	42.0	Case 1989 ¹
Nahanni	03	41	18	9	68	43.9	22.0	Larter and Allaire 2005
Nahanni	11	28	20	15	63	71.4	53.4	This study
Liard	84	175	105	77	358	60.0	42.9	Ferguson et al. 1985 ¹
Liard	87	218	81	86	385	37.2	39.4	Case 1989 ¹
Liard	03	55	31	36	122	56.4	65.5	Larter and Allaire 2005
Liard	11	116	46	41	203	39.7	35.3	This study

¹ Survey conducted in June.

The number of lambs per 100 ewes (L:E) or 100 nursery sheep (L:N) we report for the Nahanni Range in 2011 is higher than any reported previously from aerial surveys in the southern Mackenzie Mountains (Table 2). Our L:E value does fall within the range of 36.7-83.3 L:E, from 15 surveys conducted between 1996-2015 at Katherine Creek, and 17.3-94.1 L:E, from 13 surveys conducted between 1996-2015 at Palmer Lake, in the northern Mackenzie Mountains (Heather Sayine-Crawford personal communication). The Katherine Creek and Palmer Lake surveys are approximately week-long ground-based surveys conducted in June. However, our L:E value falls

above the 44-67 L:E range reported from ground-based observations of hunters, over the entire Mackenzie Mountains, collected since 1995 (Larter and Allaire 2015). The L:E we report could indicate a year of exceptional productivity for the Nahanni range.

The two surveys of the Liard Range in the 1980s were conducted over a 2-4 day period in June. These surveys included two or three additional ridges, disconnected from the main Liard Range, which were not included in the 2003 and 2011 surveys; the 2003 and 2011 surveys were conducted in <3 hours of flying on a single afternoon in August. Therefore, it is not surprising that more sheep were observed on the Liard Range in the 1980s (Table 2). The distribution of animals along the main Liard Range was consistent across all surveys except for the noticeable absence of sheep observed south of the Flett River in the 2003 survey. At the time of the 2003 survey, there was active resource development activity in the Flett River area. K-29 was operational with road access coming from the south along the west side of the Liard River. Disturbance from this activity is likely a factor in the absence of sheep observations south of the Flett River in 2003. The flightline and the length of time spent surveying were similar for the 2003 and 2011 surveys. The fact that many fewer groups and animals were observed in 2003 (Table 1) may be related to the length of survey time and the time of day the survey was conducted. The 2011 survey (173 minutes) was conducted between 1300 and 1600 hours, while the 2003 survey was only 78 minutes with most of it conducted in the early evening from 1,746 to 1,846 hours.

We observed more groups (n=20) and more total sheep (n=115) on the west side of the Liard Range. Nahanni Butte Outfitters report more sheep on the west side and believe this is a result of less bare rock and more vegetated habitats on the west side (Clay Lancaster personal communication).

The L:E and L:N we report for the Liard Range fall within the range of those reported for other aerial surveys of the area (Table 2).

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PERSONAL COMMUNICATIONS

Clay Lancaster, Nahanni Butte Outfitters, Hudson Hope, BC.

Heather Sayine-Crawford, Manager Wildlife Research and Monitoring, Sahtú Region, Norman Wells, NT.

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APPENDIX 1

The location and composition of all groups of Dall's sheep observed during an aerial survey of the Nahanni and Liard Ranges, Mackenzie Mountains, 25 August 2011. Waypoints 2-16 are from the Nahanni Range. Waypoints 17-31 are from the east side of the Liard Range. Waypoints 33-52 are from the west side of the Liard Range.

Waypoint	Latitude	Longitude	Group Composition
002	61.85294	-123.28530	ram
003	61.81198	-123.29716	2 ewes, lamb
004	61.79040	-123.33280	3 rams
005	61.73485	-123.28137	ram
006	61.72217	-123.29431	ram
007	61.72259	-123.28665	ram
008	61.69885	-123.30571	7 ewes, 2 lambs, 2 yearlings
009	61.69382	-123.32778	ram
010	61.69083	-123.33568	2 rams
011	61.65982	-123.29655	ewe, lamb
012	61.50474	-123.38610	ram
013	61.41711	-123.41846	6 ewes, 3 lambs
014	61.33618	-123.37309	ram, 3 ewes, 2 lambs
015	61.29523	-123.37848	5 ewes, 3 lambs
016	61.08404	-123.38903	3 rams, 7 ewes, 3 lambs
017	61.03887	-123.89853	2 rams
018	61.03187	-123.90560	2 rams
019	60.99500	-123.95269	ewe, lamb
020	60.99395	-123.95582	ewe, lamb
021	60.84746	-124.04005	3 rams, 10 ewes, 8 lambs
022	60.80286	-124.00828	4 ewes, 2 lambs
023	60.79759	-123.99241	4 ewes, 2 lambs
024	60.76772	-123.95533	ewe, lamb
025	60.74418	-123.92693	6 ewes, 2 lambs
026	60.73168	-123.90374	2 rams
027	60.71966	-123.90862	15 ewes, 6 lambs
028	60.72143	-123.90510	ram
029	60.61276	-123.81875	4 rams
030	60.60003	-123.80231	6 ewes, 2 lambs
031	60.59819	-123.80140	ram
033	60.56789	-123.77821	2 ewes, lamb
034	60.59138	-123.81383	ram, 5 ewes
035	60.61069	-123.82801	4 rams
036	60.61352	-123.82699	2 rams, 7 ewes, 2 lambs
037	60.66110	-123.86416	5 rams
038	60.67429	-123.86589	ram
039	60.67399	-123.87000	3 rams, ewe, lamb
040	60.67965	-123.86988	2 ewes, 2 lambs
041	60.68395	-123.87082	5 ewes, lamb

Waypoint	Latitude	Longitude	Group Composition
042	60.69546	-123.88184	6 ewes, lamb
043	60.70473	-123.90573	ram, 8 ewes, lamb
044	60.79136	-123.99690	5 rams
045	60.79770	-124.00918	2 ewes, 2 lambs
046	60.85150	-124.05730	12 ewes, 6 lambs
047	60.85187	-124.05137	6 ewes
048	60.86771	-124.05231	3 ewes, 2 lambs
049	60.89774	-124.04909	4 ewes
050	61.00145	-123.96187	3 ewes, 2 lambs
051	61.00529	-123.95117	3 rams, 2 ewes
052	61.03283	-123.91599	ram